SECTION 11 5311.18

GLOVEBOX ATMOSPHERE REGENERABLE PURIFICATION SYSTEMS

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LANL MASTER SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the LEM Mechanical POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Information within “stars” is provided as guidance to the author responsible for revising the specification. Delete information within “stars” during editing.

This specification serves as a template. The specification was prepared by an organization operating under a quality assurance program that meets the requirements of 10 CFR 830 (i.e., suitable for ML-1 through ML-4 projects). Implementation of this specification requires modification to the specification to meet project-specific requirements. Responsibility for application of this specification to meet project-specific requirements lies with the organization modifying or implementing the specification. The organization modifying the specification shall apply a graded approach to quality assurance based on the management level designation of the project. When this specification is used with nuclear facilities subject to 10 CFR 830, modification to this specification must be performed by an individual or organization operating under a quality assurance program that meets the requirements of that CFR.

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PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Glovebox atmosphere purifiers that remove oxygen and water impurities.

B. Scope

1. This section establishes the procurement and performance requirements for the materials of construction, fabrication, testing, shipment, and quality assurance (QA) of glovebox atmosphere regenerable purification systems installed at LANL. This section details specific minimum requirements for the installation and operation of a purification system within LANL. These systems include a circulation blower, dual reaction chambers, a vacuum pump, and associated valves and instrumentation.

C. Related Sections

1. Section 01 3300: Submittal Procedures

2. Section 11 5311.12: Glovebox Installation

3. Section 13 5311.17: Glovebox Instrumentation

1.2 REFERENCES

A. General

1. The standards and specifications designated below are a part of this specification to the extent specified herein. The most current revisions of standards and specifications apply. In the event of a conflict between provisions of this section and provisions of the referenced documents, the text of this section takes precedence.

B. American Society for Nondestructive Testing (ASNT)

1. ASNT-TC-1A, Recommended Practice, Personnel Qualification and Certification in Nondestructive Testing

C. ASMT International (ASTM; formerly American Society for Testing and Materials)

1. ASTM E 498, Standard Test Methods for Leaks Using the Mass Spectrometer Leak Detector in the Tracer Probe Mode

2. ASTM E 499, Standard Test Methods for Leaks Using the Mass Spectrometer Leak Detector in the Detector Probe Mode

D. Code of Federal Register

1. 10 CFR 830.122, Quality Assurance, http://www.access.gpo.gov/nara/cfr/cfr-table-search.html#page1

E. International Organization for Standardization

1. ISO 9001, Quality Management Systems Requirements

1.3 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

A. atm: atmosphere

B. acfm: Actual Cubic Feet per Minute

C. CMTR: Certified Material Test Report

D. COC: Certificate of Conformance

E. DC: Direct Current

F. Hz: Hertz

G. NDE: Nondestructive Examination

H. NPT: National Pipe Thread

I. ppmv: Parts per Million by Volume

J. PTFE: Polytetrafluoroethylene

K. psig: Pounds per Square Inch Gauge

L. QA: Quality Assurance

M. scc: Standard Cubic Centimeters

N. scfm: Standard Cubic Feet per Minute

O. UHMWPE: Ultra High Molecular Weight Polyethylene

P. UL: Underwriter's Laboratory

Q. VAC: Volts Alternating Current

R. W.C.: Water Column

1.4 SYSTEM DESCRIPTION

A. Performance Requirements

1. Flowrate

a. Inert gas rate through the regenerative chambers: adjustable from 0 to 40 scfm.

b. Flow regulation shall be user controlled in 10% increments.

c. The dual chambers shall be plumbed such that continuous sorption is maintained in one (either) chamber while the other is regenerating.

2. Minimum Oxygen/Water Removal Capacity for each chamber

a. Oxygen: 0.7 standard cubic feet.

b. Water: 4.4 pounds.

c. The inlet concentration to the purification unit shall not exceed 200 ppmv of oxygen (this is to prevent the operating bed from having a shorter run time than the regeneration time).

3. Outlet purity

a. The combined oxygen and moisture content of the recirculating gas leaving the chamber from the purification unit shall be no greater than 1 ppmv oxygen and 1 ppmv moisture.

b. The purification unit described in this specification shall maintain an atmosphere of 1 ppmv or less of water and 1 ppmv or less of oxygen in gloveboxes that vary in size from 150 to 250 cubic feet in volume.

B. Safety

1. The regeneration cycle shall abort if the regeneration gas supply is interrupted.

2. Interlock user-adjustable safety set point (+/- 10 inches water column range) to the inert and regeneration valves, vacuum valve and vacuum pump, all of which shall be deactivated in a high or low pressure situation.

3. Temperature of the gas in the return line to the glovebox shall be not more than 10°C (18°F) above ambient room temperature.

4. Provide visual display on the unit for the blower speed/flowrate, regeneration status, pressure display of safety set point, and glovebox pressure.

1.5 SUBMITTALS

A. Submit the following in accordance with Section 01 3300, Submittal Procedures:

1. Documentation of ISO 9001 certification in accordance with Section 1.6

2. An uncontrolled copy of the supplier's QA plan identifying procurement, fabrication, test and inspection, material traceability and nonconformity controls for approval

3. Helium leak test procedure per ASTM E499; pressure during helium leak test to be +10" W.C.

4. Helium leak test procedure per ASTM E498

5. Test reports with signatures by personnel who either performed or witnessed the helium leak test and who hold either Level II or Level III certification in accordance with ASNT SNT-TC-1A

6. NDE certifications for test personnel for approval, prior to testing

7. CMTRs (alloy designations) for all process-wetted surfaces, consisting of legible copies of mill test reports indicating chemical analysis, physical test data, and heat number; COCs may be provided in lieu of CMTRs with prior LANL approval.

8. Calibration data sheets for all instrumentation

9. Circuit wiring diagrams and electrical schematics (wiring drawings show the point-to-point wiring of a piece of equipment or between pieces of equipment in a system)

10. Supplier's installation instructions, step-by-step if necessary, showing the field installation of the purification unit and associated equipment and components

11. Functional test procedure

12. Catalog data for blower, vacuum pump and valves; identify manufacturer, model number, and materials for all process-wetted surfaces

13. Performance Data/Curves: Provide the following performance data:

    a. Blower: Pump curve of flowrate as a function of differential pressure.

    b. Vacuum Pump: Displacement, pumping speed, pump curve of flowrate as a function of pressure.

    c. Catalyst: Data for oxygen capacity as a function of temperature and chemical composition.

    d. Molecular Sieve: Data for water capacity.

14. Documentation of cleaning techniques to be used during manufacture; use of Freon™ or other fluorocarbon cleaners is not allowed

15. Within 30 days after receipt of order, three copies of dimensioned detailed drawings of the proposed purification unit, illustrating sizes, types and locations of all control panel components, electrical, vent, circulating, regeneration gas and makeup gas (if applicable) connections, pump, blower, valves and piping; approval drawings shall indicate overall dimensions of the unit and wheels or stanchions

16. Before or at the time of shipment, two copies per purification unit of a complete operating and maintenance manual; information contained in the manual shall include operation and maintenance instructions specific to the purification unit supplied

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Suppliers currently on LANL's approved vendor list may not be required to submit a copy of their QA plan.

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1.6 QUALITY ASSURANCE

A. As used in this document, QA is intended to control a combination of materials, preparation, fabrication, inspection, testing, cleaning, packaging, and shipping to be done to ensure the protection of an acceptable finished product. Maintain a QA program in accordance with 10 CFR 830.122. If the supplier's QA plan is not in accordance with 10 CFR 830.122, LANL approval is required for the supplier's QA program.

B. The manufacturer shall be an ISO 9001 certified supplier.

C. Personnel Certifications: Provide evidence that supplier personnel assigned to testing and inspections are fully qualified to perform their respective job functions. Provide NDE personnel performing leak testing operations that are certified in accordance with the requirements of ASNT SNT-TC-1A.

D. Test Reports: Ensure that tests performed in support of the purification system fabrication, welding, assembly, testing, and inspection are fully documented.

E. Reliability

1. Supplier shall show proof of experience sufficient to ensure continued maintenance support.

2. The supplier is encouraged to use standard parts where practicable to ensure availability.

F. LANL Surveillance and Audits

1. LANL reserves the right for its authorized representatives to obtain access to supplier facilities, including sub tier suppliers, vendors, and subcontractors, for review, audit, surveillance, witness, inspection and/or testing activities.

1.7 DELIVERY, STORAGE AND HANDLING

A. Remove water from cavities to protect against damage caused by freezing. Cap, plug, or otherwise seal openings against the intrusion or water, dirt and debris.

B. Pack purification unit in a manner suitable for shipment by air-ride truck or trailer.

C. Small miscellaneous items that are not shipped as a part of the main purification unit shall be properly packaged, attached to and shipped with the unit for which they are intended.

1.8 WARRANTY

A. The supplier guarantee against failure in proper use or operation caused by defective materials and/or workmanship for a period of 1 year from the date of acceptance.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Comply with Section 01 2500, Substitution Procedures.

2.2 SUPPLIERS

A. Vacuum Atmospheres Company, PO Box 1043, 4652 West Rosecrans Ave, Hawthorne CA 90250-6896. Phone: 310.644.0255

B. M. Braun Inc., 14 Marin Way, Stratham, NH 03885. Phone: 603.773.9333

## 2.3 MATERIALS

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Environment and process conditions should be taken into account during material selection. Considerations include corrosives, radiation, thermal cycling, etc.
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A. High Temperature: Construct components of the system that experience temperatures in excess of 100°C (212°F) and that are in contact with the recirculating gas or with exhaust gas under normal operating conditions with 304 or 316 stainless steel. Components that serve to isolate the recirculating gas or the exhaust gas and are not available in stainless steel can be excluded from this requirement with prior approval from LANL.

B. Low-Temperature: Construct components (lines, valves, fittings, etc.) that do not experience temperatures in excess of 100°C (212°F) and are in contact with recirculating gas or exhaust gas with stainless steel, copper, brass or any combination of the three. When two dissimilar metals are used and water is present, provide a dielectric union between the two metals.

C. Construct the containment on all flexible connections on the recirculating gas lines with stainless steel, copper, or brass in accordance with the temperature limits above.

D. Do not use rubber, plastic, fluoropolymers (e.g., Teflon, PTFE) or fluoroelastomers (e.g., Viton) if these materials have the possibility of coming in contact with radiation. If the normally-supplied valve seals are constructed of these materials, replace them with UHMWPE, Vespel, or other material more resistant to radiation.

E. Elastomeric o-rings may be used where required, in low-temperature connections only.

## 2.4 COMPONENTS AND CONFIGURATION

1. All user functions shall be controlled from a manual keypad.

2. Functions and glovebox conditions shall be displayed on a color monitor.

3. Dimensions

   a. The maximum dimensions for each unit shall not exceed a height of 35 inches, a depth of 23 inches and a width of 47 inches.

   b. The vacuum pump may be located inside or outside the chassis dimensions.

   c. Units may be split into two parts reducing the overall dimension of each unit to allow installation into smaller areas.

4. Panels on the unit (if applicable) or a portion thereof shall be removable, to permit servicing and replacement of valves, blower, and/or vacuum pump, and to allow replacement of sorbant materials when necessary. Other panels shall be removable to allow easy access to all parts of the unit.

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Purification units installed at TA-55 require anchor points for seismic considerations. At other facilities it may be acceptable to provide the entire unit equipped with wheels, skids or other devices to allow the unit to be moved if necessary. The unit must be provided with lockable wheels or a stabilizing stanchion to prevent inadvertent movement of the unit for seismic considerations.
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5. Equip entire unit with anchor points attached to the structural frame, such that the unit may be positively anchored to the building floor or support structure.

B. Blower

1. Sealed unit capable of maintaining the specified gas flows through the glovebox adsorbent chambers continuously.

2. Motor: Brushless, DC-controlled, and UL- approved. No heat exchanger or cooling water is required.

C. Vacuum Pump

1. Minimum capacity of 4.1 acfm, ultimate vacuum of $7 \times 10^{-2}$ atmospheres, UL listed.

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Select the use of either an oil pump or dry pump, deleting reference of the pump that is not used.
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2. Oil Pump: An oil based pump requires an outlet mist filter and gravity oil return kit.

3. Dry Pump: A dry pump requires no additional lubrication and is preferred to prevent contamination of fluids within the pump.

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Deleting Oxygen Analyzer requirement if not desired.
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D. Oxygen Analyzer

1. Install a depleting-type Teledyne Oxygen Analyzer on the inlet to the purification unit.

2. Locate the oxygen analyzer in an operator accessible location (for maintenance considerations).

3. Refer to Section 11 5311.17, Glovebox Instrumentation for oxygen analyzer requirements.

E. Pressure Gauge

1. Provide gauge for the purifier vessels.

PART 3 EXECUTION

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Installation of the glovebox atmosphere regenerable purification system is to be completed using facility-specific standards. Refer to Section 11 5311.12, Glovebox Installation for additional information.
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3.1 INSTALLATION AND UTILITY REQUIREMENTS

A. Connect 115 VAC single Phase-60 Hz power to the purification unit through a single easily accessible electrical box.

B. Connect main gas supply and return at the purifier unit to the glovebox piping with flanged connections.

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Gas supply to the purification system regulated to 35 psig is needed to operate the pneumatic valves for Vacuum Atmospheres model VAC 102219, TA-55 standard purification system. Some models manufactured by Vacuum Atmospheres have valves that are electrically actuated. The 35 psig gas does not have a path to connect to the glovebox atmosphere and as a result can be either an inert gas or compressed air.

The inert gas supply at 35 psig can be used for pressure control and makeup for the glovebox in addition to operating the pneumatic valves inside the purification unit, this is a modification to Vacuum Atmospheres Model VAC 102219. Modification of Section 11620 will be required to incorporate additional pressure regulation and modification of the glovebox pressure control done by the photohelic. Additionally an orifice must be added to the inert gas line to prevent over pressurization of the glovebox if a valve should fail or other non-normal event should occur.
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C. Gas supply for pneumatic valve operation

1. Regulate gas pressure to an inlet pressure of 35 psig.

2. Provide gas supply with appropriate valves and filters per facility standards. Refer to Section 11 5311.12, Glovebox Installation, for appropriate configuration.

D. Regeneration gas supply

1. Provide regeneration gas supply with the appropriate valves and filters per facility standards. Refer to Section 11 5311.12, Glovebox Installation, for appropriate configuration.

2. Provide regeneration gas shall of argon with 3-5% hydrogen. Regulate the regeneration gas to an inlet pressure of 25 psig.

3. Control regeneration gas flow via the purification unit.

E. Mole Sieve Regeneration Piping

1. Design piping such that water from the regeneration stream is contained and easily disposed of before the stream enters the vacuum pump.

F. Pressure Sensing

1. Equip the oxygen and water purification unit with a pressure sensing line to monitor the pressure within the glovebox.

G. Vent Lines

1. Purge venting is required during regeneration of the catalyst and shall be connected to a suitable exhaust line in the facility. Provide a purge vent line with appropriate valves and filters per facility standards; refer to Section 11 5311.12 for appropriate configuration.

2. Vacuum pump shall remove water from the sieve bed during regeneration and be connected to a suitable exhaust line in the facility. The vacuum pump exhaust line shall have appropriate valves and filters per facility standards; refer to Section 11 3511.12, Glovebox Installation, for appropriate configuration.

H. Cooling Requirements

1. Purification systems do not require supplemental cooling to obtain outlet temperature requirement in Section 1.4.B.3

3.2 FIELD QUALITY CONTROL

A. Site tests and Inspections

1. Functionally test the oxygen and water purification unit before putting into regular operation to verify that the performance meets those requirements in Section 1.4.

2. Conduct helium leak test before the purification system is put into operation and last isolation valve is opened to connect the purification system to a contaminated glovebox. Refer to ASTM E498 for testing procedure. The entire system can have no detectable leaks when helium leak-tested with equipment capable of detecting a leak of $1 \times 10^{-6}$ scc/sec.

3.3 STARTUP

A. Regenerate the purification unit regenerated three times before bringing online.

END OF SECTION

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Do not delete the following reference information.
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FOR LANL USE ONLY

This project specification is based on LANL Master Specification 11 5311.18 Rev. 0, dated January 6, 2006.